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ABSTRACT

The purpose of this investigation was to examine historical changes in aptitude scores. Recent literature suggesting a decline in the quality of the U.S. workforce is reviewed, and an expectation that score distributions on aptitude tests have shifted in a negative direction is presented. Archival analyses of normative data for the Short Employment Tests (SET), a widely used measure of clerical aptitude, are then described. These analyses revealed that scores on the SET numerical aptitude subtest increased between 1956 and 1972, then decreased between 1972 and 1992. Contrary to expectations, however, scores on the verbal and clerical aptitude subtests increased over time. Possible explanations for the trends in SET subtest scores are discussed. Includes three tables and one figure. (Contains 4 references.) (Author/SLD)

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Historical Trends in Aptitude Scores: A Case Studies of the SET

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RUNNING HEAD: Trends in Aptitude Scores

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Abstract

The purpose of this investigation was to examine historical changes in aptitude scores. Recent literature suggesting a decline in the quality of the U.S. workforce is reviewed, and an expectation that score distributions on aptitude tests have shifted in a negative direction is presented. Archival analyses of normative data for the *Short Employment Tests (SET)*, a widely used measure of clerical aptitude, are then described. These analyses revealed that scores on the SET numerical aptitude subtest increased between 1956 and 1972, then decreased between 1972 and 1992. Contrary to expectations, however, scores on the verbal and clerical aptitude subtests increased over time. Possible explanations for the trends in SET subtest scores are discussed.

Historical Trends in Aptitude Scores: A Case Studies of the SET

A dramatic interplay of economic, technological, and demographic forces is currently reshaping the world of work and redefining the role of the American worker. Occupational alternatives are changing as a result of the shift in U.S. economy away from manufacturing and toward service-based industries. Of 25 million new jobs created by the year 2000, the majority will be in management, administrative support, sales and service (Hudson Institute, 1987). Furthermore, advancing technology will render these jobs qualitatively different from those available in the past. Basic skill levels that once were sufficient for many positions will be inadequate in technologically advanced work environments. As the American Management Association reported:

> "In the future, work will increasingly depend upon the ability to receive, understand, and act upon *written information*. More jobs, especially those in the growing service industry, will require higher levels of reading skills and greater facility with numbers (American Management Association, 1989)."

Such drastic changes in the workplace are not, however, being mirrored by changes in the *workforce*. The traditional pool of qualified 16 to 24 year-old workers is shrinking and employers are developing entry-level workforces with less qualified workers. Consider the following:

- there are 27 million functionally illiterate adults in the U.S. and additional millions are unable to learn job skills from manuals or instructional materials (American Management Association, 1989);
- Educational Testing Service reported in 1988 that fewer than half of the nation's 17 year-old high school students could figure the area of a rectangle, or knew that "87 percent of 10" was *less* than 10;
- by the year 2000, only 10% of the entering workforce will be able to solve for x in a simple algebraic equation (Hudson Institute, 1987).

Given such discrepancy between workplace demands and workforce ability, employers have but one recourse: assess the quality of available workers and offer remedial training to those who lack the ability to successfully perform on the job (American Management Association, 1989).

One approach for assessing worker quality is that of *aptitude* measurement. Aptitude tests are designed to measure the combination of abilities and other characteristics, whether innate or acquired, that indicate an individual's ability to learn or develop proficiency in some area if appropriate education or training is provided. Rather than measuring the extent to which a person has already acquired certain information or mastered certain skills, aptitude tests measure the individual's capacity, or potential, to learn if given the opportunity (Bennett & Gelink, 1993). This type of assessment fits well with plans to provide remediation of basic skills, allowing identification of those most likely to benefit from such remediation.

Given the nature of aptitude tests, one might expect that the trends in workforce quality described previously would be mirrored in test scores. That is, scores on aptitude tests should have declined over the years, just as the basic skill levels of the U.S. workforce have declined. This expectation was evaluated by examining temporal changes in scores on the *Short Employment Tests (SET;* Bennett & Gelink, 1993). The SET are three, five-minute tests assessing verbal, numerical, and clerical aptitude. Used extensively in selection and training of administrative support workers since 1951, the SET have demonstrated reliability and criterion-related validity in a variety of settings. Ideally, examination of temporal changes in aptitude scores would involve regression of SET scores on time and the removal (i.e., partialling-out) of effects such as educational attainment, socioeconomic status, and other demographics. While the archival data available for study was collected during three different time periods, they were in the form of norms tables for various occupational groups. Such data -- consisting of raw scores corresponding to 23 selected percentiles, sample sizes, sample means, and sample standard deviations -- allowed only limited statistical analysis possibilities.

Method

For each data collection period identified in the *Manual for the Short Employment Tests* (Bennett & Gelink, 1993) -- 1956, 1972, and 1992 -- normative groups were identified which 1) contained at least 100 cases, and 2) contained respondents who were applicants or employees in a clerical occupation. Measures of central tendency available for each of these groups were then combined to generate a grand mean, average standard deviation, and total sample size for each SET subtest (i.e., verbal, numerical, and clerical aptitude). The grand mean for each subtest was calculated in the following way:

$$\overline{X_T}=(\Sigma n_i \overline{x_i})/N_T$$

where X_T = the grand mean, n_i = number of cases in sample i, x_i = mean score of sample i, and N_T = total sample size. Average variance across samples was calculated using the following formula:

$$\sigma^2_T=\frac{1}{N}\Sigma N_i\sigma^2_i+\frac{1}{N}\Sigma N_i d^2_i$$

where σ^2_T = the total variance, N = total sample size, N_i = number of cases in sample i, σ^2_i = standard deviation for sample i, and $d_i = X_i - X$ (Mueller, Schuessler, & Costner, 1977). The square root of the resulting value was taken to estimate the standard deviation (σ_T) of the combined distribution.

Results

The three measures (i.e., grand mean, average standard deviation, and total sample size) resulting from the combination of sample distributions for each date of data collection are presented in Table 1. A separate one-way ANOVA was conducted for each set of subtest scores, using matrix input to the SPSS-PC procedure ONEWAY. The results of these analyses, presented in Table 2, indicated that for all three subtests, SET scores have changed significantly over time. *Post hoc* comparisons using the Scheffe test ($\alpha = .01$) indicated that, for all three subtests, mean scores at each time period were significantly different from one another. Examination of the means (see Figure 1) reveals that numerical aptitude scores increased from 1956 to 1972, but decreased drastically between 1972 and 1992. Contrary to expectations,

scores on the verbal and clerical aptitude subtests have increased since the development of the SET.

In an effort to investigate whether or not these trends could be replicated for a more specifically defined occupational group, weighted means and average variances by publication date were calculated for a subsample of bank secretaries, clerks, and tellers. As Table 3 reveals, the resulting measures were almost identical to those for the larger sample; thus, additional analyses were not performed for the smaller, more well-defined sample.

Discussion

Given the plethora of studies warning of the decline in basic reading, writing, and mathematical skills (American Management Association, 1989), the trends in SET aptitude scores are somewhat surprising. The expected decrease in scores was observed only for the numerical aptitude subtest. Given that this subtest consists of items requiring the respondent to perform *manual* mathematical operations, increased reliance on automation (e.g., calculators, computers, etc,) at home and in the workplace is a plausible explanation for this trend. The increases in verbal and clerical aptitude scores over time were, on the other hand, unexpected. There are, of course, numerous explanations for this phenomenon. One intriguing possibility involves changes in average educational attainment of the workforce and the nature of the SET. Increased educational attainment is apparently not being translated into increased basic skills; however, it may be affecting the ability to *learn* new skills. As *aptitude*, rather than skills, tests, the SET may be tapping such changes. "Teaching to the test" is not a plausible explanation, as the SET are secure tests (i.e., the tests are not sold to employment agencies or schools).

The trends in scores observed for the SET are mirrored in another aptitude measure, the *General Clerical Test* (GCT; The Psychological Corporation, 1988). GCT-Clerical scores have increased slightly since the test's development; in 1950, the average score on the GCT clerical subtest was 42.81, in 1972 it was 49.23, and in 1988 it was 49.72. The trend in GCT-Numerical scores was similar to that of SET numerical subtest scores: 26.02 (1950), 28.72 (1972), and 24.73 (1988). GCT-Verbal scores, unlike SET

verbal subtest scores, have decreased since 1972. This measure, however, is quite different from the SET verbal subtest. The GCT verbal subtest assesses spelling, reading comprehension, vocabulary, and grammar, while the SET verbal subtest assesses general word knowledge.

In summary, historical trends observed in scores on the *Short Employment Tests* seem to be at odds with research suggesting that the quality of the U.S. workforce is declining. While many workers may be lacking basic *skills*, the present analyses suggest that they are becoming better equipped to learn new job skills: verbal and clerical *aptitude* has increased. The analyses conducted in the present study, while quite exploratory, suggest that more complex investigations of workforce aptitude would be worthwhile. Future investigations of the difference between skills and abilities possessed by U.S. workers and the aptitudes those workers bring to the job will have important implications for employers, human resource departments, and training programs.

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Table 1

SET Subtest Scores by Date of Data Collection: Clerical Occupations

	Verbal			Numerical			Clerical		
Date	N	Mean	SD	N	Mean	SD	N	Mean	SD
1956	42,788	24.09	12.20	42,788	31.88	14.23	42,788	28.59	7.80
1972	10,357	25.15	11.88	10,988	32.94	14.87	11,115	31.80	9.34
1992	4,276	29.71	11.94	4,277	27.42	12.14	4,526	36.73	9.88

Table 2

ANOVA Results

Dependent Variable: Verbal Score

Source	DF	SS	MS	F	prob.
Between groups	2	125,346.73	62,673.36	426.40	.001
Within groups	57,418	8,429,464.32	146.98		
Total	57,420	8,564,811.05			

Dependent Variable: Numerical Score

Source	DF	SS	MS	F	prob.
Between groups	2	96,472.03	48,236.01	238.84	.001
Within groups	58,050	11,723,670.26	201.96		
Total	58,052	11,820,142.29			

Dependent Variable: Clerical Score

Source	DF	SS	MS	F	prob.
Between groups	2	324,409.81	162,204.91	2,360.75	.001
Within groups	58,426	4,014,402.70	68.71		
Total	58,428	4,338,812.51			

Table 3

SET Subtest Scores by Date of Data Collection: Bank Secretaries, Clerks, and Tellers

	Verbal			Numerical			Clerical		
Date	N	Mean	SD	N	Mean	SD	N	Mean	SD
1956	36,567	23.60	12.00	36,567	32.00	14.10	36,567	28.50	7.70
1972	2,209	24.49	11.06	2,659	36.13	14.03	2,659	35.55	9.71
1992	459	28.41	12.04	459	29.35	13.60	459	36.79	9.14

Figure 1

Mean SET Subtest Scores: Clerical Jobs